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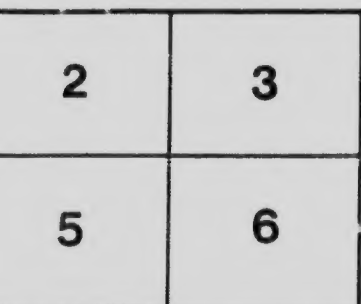
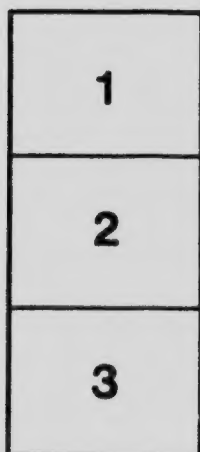
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EXHIBITION CIRCULAR No. 28.
DOMINION OF CANADA.
DEPARTMENT OF AGRICULTURE.
EXPERIMENTAL FARMS.

J. H. GRISDALE, B. Agr.,
Director.

FRANK T. SHUTT, M.A.,
Dominion Chemist.

DIVISION OF CHEMISTRY.

THE FARMER AS A MANUFACTURER

BY

A. T. STUART, B.A., Assistant Chemist.

Part III.—Farm Products: Food and clothing materials—their formation and composition.

THE PROCESSES OF LIFE.

It is in the little cells, of which all plants and animals are constructed, that the manufacture of Protein, Fat, Carbohydrates and Fibre as well as colours, odours and flavours take place. Each cell is a wonderful chemical factory.

Under the microscope all plants and animals are found to be made up of little cells or pouches. Some consist of only one or few cells, such as brewers' yeast, while others, as for instance, a tree or a cow, are made up of thousands upon thousands. The cells of the orange and lemon are so large that they can be readily seen, when cut.

If we closely examine a cell we shall gain some idea of the structure of all that grows—both plants and animals. As an example, take a cell of the Jerusalem artichoke seen under a microscope which will magnify it 230 times. It resembles a little bag filled with water. Within the cell is a little round body, 'the nucleus.' A viscous turbid fluid, protoplasm, lines the inside of the cell-wall and is connected with the nucleus. This liquid plays a very important part in all the processes of life and from it everything else is manufactured. We thus have:

1. The wall—fibre or tissue.
2. The contents lining the wall—protoplasm.
3. Little body in centre—nucleus.
4. Clear liquid—sap.

Cotton, flax and hemp consist of long slender cells, in wood the cells are long and arranged in bundles. All living cells are distended with liquids; in plants which yield oil small droplets of oil are to be seen, while coloured and milky juices travel up and down in the specialized spaces between the cells. The size of plant cells varies from often less than $\frac{1}{2000}$ -inch to 12 inches, as in seaweed. All growth in plants and animals results from an increase in the number of cells. The nucleus divides into two parts and walls grow around each, and thus we have two cells. In small plants like yeast, the growing cells separate, while in trees the cell walls stick together and form fibre. In the puff ball, which in a single night may grow as large as a peck measure, the cells multiply at the rate of 400,000,000 per hour.

By even a slight acquaintance with the nature of a cell one is better able to understand the principles underlying the feeding of plants and animals, and thus will be in a better position to feed his crops and stock economically. Each cell is a wonderful little factory in itself. There are no doors or windows so that all materials must come in through the cell walls. Inside the cell, the nucleus, in the case of plants, manufactures plant protein, fats and carbohydrates; and in the case of animals, animal protein, fats, but no carbohydrates.

Furthermore materials to be useful, for life, must be capable of being dissolved in water by means of various natural agents. We speak of plant food being 'available' and of animal food being 'digestible.' Food in any other condition is useless and represents mere waste.

In the case of animals the food is acted upon by the digestive juices which enable it dissolve in water. In such form the food then passes through the walls of the little blood vessels and is transported to all parts of the body to be delivered to the working and growing cells.

This brings us to a study of the products of the farm—the various forms of protein, fat, carbohydrates and fibres.

THE PRODUCTS OF THE FARM.

PROTEIN, FAT, CARBOHYDRATES AND FIBRES.

The products of the farm are thus classified:

- (a) Plant products.—1. For human food, direct.
2. For stock food, direct.
3. For manufacture of foods, clothing and shelter.
- (b) Animal products.—1. Human food, direct.
2. For manufacture of food, clothing and shelter.

STOCK FOODS.

The following tables are of considerable interest as showing that the nature of the apparently great variety of materials is comparatively simple and can be easily understood. By reading the figures one will be able to distinguish between good and valuable products and inferior ones.

COMPOSITION OF IMPORTANT FEEDING STUFFS.

	Waste.		Valuable.		
	Water	Indigestible.	Protein.	Digestible Carbo-hydrates.	Fat.
Corn products—					
Corn kernel.....	11	9	8	67	4.3
Corn and Cob meal.....	15	16	4	69	3
Gluten meal.....	8	12	26	43	11
Germ meal.....	10	14	9	61	6
Sugar meal.....	7	13	19	52	9
Wheat products—					
Wheat.....	10	9	10	69	2
Low grade flour.....	12	16	8	63	1
Wheat bran.....	12	34	12	39	3
Wheat shorts.....	12	12	12	50	4
Wheat middlings.....	12	18	13	53	3.5
Wheat screenings.....	12	25	10	51	2
Rye products—					
Rye.....	12	9	10	68	1
Rye bran.....	12	24	11.5	50	2
Rye shorts.....	9	32	12	45	1.5
Barley products—					
Barley.....	11	12	9	66	1.5
Malt sprouts.....	10	32	19	37	1.5
Brewer's grains, wet.....	76	10	4	9	1.5
" " dried.....	8	35	16	36	5
Oat products—					
Oats.....	11	29	9	47	4
Oat meal.....	8	22	11.5	52	6
" feed or shorts.....	8	30	12.5	47	3
" dust.....	6	42	9	38	5
" hulls.....	9	50	1	40	5
Buckwheat.....	12	29	8	49	2
Oil bearing seeds—					
Flax seed.....	9	24	21	17	29
Linseed meal (old process).....	9	22	29	33	7
" (new ").....	10	19	28	40	3
Cotton seed meal.....	8	26	37	17	12
" " hull.....	11	54	33	33	1.5
Sunflower seed.....	7	31	12	21	29
Peas.....	10	20	17	52	1
Green fodder corn.....	80	5.5	1	12	4
Fodder corn (field cured).....	58	3.5	2.5	35	1
The Grasses: pasture and soiling —					
Grasses—					
Pasture grass (mixed).....	80	7	2.5	10	5
Timothy.....	62	17	1.2	19	6
Red top, in bloom.....	65	11	2.1	21	6
Oat fodder.....	62	15.5	2.6	19	1
Hay—					
Timothy.....	13	40	2.8	43	1.4
Red top.....	9	38	4.8	47	1
Mixed grasses.....	13	39	6	41	1.2
Straw—					
Wheat.....	10	53	4	36	4
Oat.....	9	50	1.2	39	8
Green forage (legumes) —					
Red clover.....	70	11	3	15	7
Alfalfa.....	70	12	4	13	5
Cow pea.....	85	4	2	9	2
Soya bean.....	75	10	3.2	11	5
Hay and Straw (legumes) —					
Red clover.....	15	40	7	36	1.7
Alfalfa.....	9	39	11	49	1.2
Cow pea.....	11	34	11	39	1.1
Soya bean (straw).....	11	46	2.3	40	1
Roots and tubers—					
Potatoes.....	80	3	1	16	1
Sugar beets.....	87	2	1.1	10	1
Mangels.....	90	3.5	1.1	5.4	1
Turnips.....	90	1.5	1.1	7.2	2
Rape.....	85	5.5	1.5	8	2
Manufactured products—					
Dried blood.....	9	36.5	52	.....	2.5
Meat scrap.....	11	9	66	.....	14
Beet pulp.....	90	2.5	6	7	.....
" molasses.....	20	11	9	60	.....

The food requirements of an animal, both as to quantity and quality, are determined by its age and function. A young and growing animal needs a liberal ration rich in protein and bone-forming material; a mature animal doing no work can do very well on a ration comparatively poor in protein. Economy in feeding is attained by meeting the requirement of special cases—cows in milk, steer fattening, laying hens, &c.

The value of food (protein, fat and carbohydrates) can be measured by the amount of energy it is able to develop for supplying the body with warmth and strength. The measure used is called a calory. In the following table the composition and 'fuel value' of the more common human foods are given, together with the figures showing the relative costs to the consumer.

HUMAN FOODS.

	In digestible refuse.	Water.	Protein.	Fat.	Carbo-hydrates.	Ash.	Calories (fuel value) per pound.
	%	%	%	%	%	%	
Beef, fresh—							
Sirloin steak.....	12.8	54.0	16.5	16.1	.....	0.9	970
Loin.....	13.3	52.5	16.1	17.5	.....	0.9	1,025
Shank.....	36.9	42.9	12.8	7.3	.....	0.6	545
Corned beef.....	8.4	49.2	14.3	23.8	.....	4.6	1,245
Tongue, pickled.....	6.0	58.9	11.9	19.2	.....	4.3	1,010
Veal, leg.....	14.2	60.1	15.5	7.9	.....	0.9	625
Mutton, hind leg.....	18.4	51.2	15.1	14.7	.....	0.8	890
Lamb, hind leg.....	17.4	52.9	15.9	13.6	.....	0.9	840
Pork, fresh ham.....	10.7	48.0	13.5	25.9	.....	0.8	1,320
Pork, smoked ham.....	13.6	34.8	14.2	33.4	.....	4.2	1,635
Sausage, pork.....	.....	39.8	13.0	44.2	1.1	2.2	2,075
Eggs, hen's.....	11.2	65.5	13.1	9.3	.....	0.9	635
Butter.....	.....	11.1	1.0	85.0	.....	3.0	3,410
Milk, whole.....	.....	87.0	3.3	4.0	5.0	0.7	310
Cream.....	.....	74.0	2.5	18.5	4.5	0.5	865
Cheese, full cream.....	.....	34.2	25.9	33.7	2.4	3.8	1,885
Flour.....	.....	12.0	11.4	1.0	75.1	0.5	1,635
Bread, white.....	.....	35.3	9.2	1.3	53.1	1.1	1,200
Soda crackers.....	.....	5.9	9.8	9.1	73.1	2.1	1,875
Molasses.....	.....	.....	.....	.....	70.0	.....	1,225
Candy.....	.....	.....	.....	.....	96.0	.....	1,680
Sugar.....	.....	.....	.....	.....	100.0	.....	1,750
Beans, dried.....	.....	12.6	22.5	1.8	59.6	3.5	1,520
Cabbage.....	15.0	77.7	0.9	0.2	4.8	0.9	115
Onions.....	20.0	78.9	1.4	0.3	8.9	0.5	190
Potatoes.....	20.0	62.6	1.8	0.1	14.7	0.8	295
Apples.....	25.0	63.3	0.3	0.3	10.8	0.3	190
Oranges.....	27.0	63.4	0.6	0.1	8.5	0.4	230
Watermelons.....	59.4	37.5	0.2	0.1	2.7	0.1	50
Raisins.....	10.0	13.1	2.3	3.0	68.5	3.1	1,265
Peanuts.....	24.5	6.9	19.5	29.1	18.5	1.5	1,775
Chocolate.....	.....	5.9	12.9	48.7	30.3	2.2	5,625

Ten cents will purchase—

Beef, sirloin.....	540 calories.	(Energy, heat, etc).
Beef, stew meat.....	1,530 "	
Mutton chops.....	890 "	
Roast pork, loin.....	1,035 "	
Pork, fat, salt.....	2,950 "	
Halibut, fresh.....	295 "	
Salmon, canned.....	760 "	
Oysters.....	100 "	
Butter.....	1,125 "	The most expensive food in list.
Eggs.....	385 "	
Cheese.....	1,185 "	
Milk.....	885 "	
Wheat flour.....	6,000 "	
Corn meal.....	6,540 "	The cheapest food in list.
Oatmeal.....	4,500 "	
Rice.....	2,025 "	
Wheat bread.....	2,400 "	
Beans, white, dry.....	3,040 "	
Celery.....	130 "	
Potatoes (90c. bush).....	1,970 "	
Turnips.....	1,200 "	
Apples.....	1,270 "	
Bananas.....	370 "	
Sugar.....	2,920 "	

FACTORY PRODUCTS.

The farmer manufactures from air, water and soil all the varieties of food and clothing—protein, fat, carbohydrates, tissues and fibres, colours, odours, flavours, digestives, poisons, alkaloids, etc. The so-called manufacturer merely sorts these out by machinery and chemical processes and sells or uses them for various purposes. Who is the real manufacturer?

In the first column of the following table we have the constituents of plants and animals produced on the farm; in the second column there is the disposition of those from plant sources, in the third that of the products from animals.

Farm Products.	Factory Products.	
	(a) Plant.	(b) Animal.
I. Protein.....		Meats, casein, glue, gelatin, etc.
II. Fats.....	Oils..... Linseed oil, corn oil, cotton seed oil, etc., for paints, soap, lubricants.	Oleo oil, lard oil, etc., for soaps, lubricants, etc.
	Fats..... Stearin.....	Lard, tallow, greases, etc.
	Wax..... Carnauba.....	Beeswax.
	Gums..... Rubber, chewing gum.....	
III. Carbohydrates.....	Sugar, candy, starch, beer, whiskey, pastes, etc.	None.
IV. Mineral.....		Bone products.
V. Tissues and Fibres.....	Cotton, linen, wood and paper....	Wool, hair, leather, silk.
VI. Colours, odours, flavours, digestives, alkaloids, poisons and all plant extracts.		

